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(71) Applicant: CCL SYSTEMS LIMITED
Cabco House Ewell Road
Surbiton Surrey KT6 7AH(GB)

(72) Inventor: Davison, John
24 Malinson Oval
Harrogate Yorkshire HG2 9HH(GB)

(72) Inventor: Holdsworth, Steven
1350 South Heincke Road
Miamisburg Ohio 45342(US)

(74) Representative: Shaw, Laurence
George House George Road
Edgbaston Birmingham B15 1PG(GB)

(54) Two part connector for concrete reinforcing bars.

(57) A connector for joining two concrete reinforcing bars in end-to-end relation comprises only two parts. Each part is a sleeve having an end portion to be swaged to a bar and an interengaging portion, the intergaging portions being threaded. The connection may be made on site using unskilled labour.

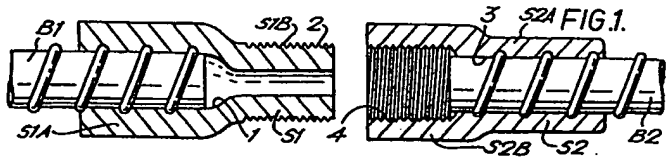

FIG.1.

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TWO PART CONNECTOR FOR CONCRETE REINFORCING BARS

The invention relates to the joining of a pair of concrete reinforcing bars or rods or the like, in end-to-end relation. In particular the invention concerns the joining of the bars in end-to-end relation by means of a two part connector in such a way that the tensile strength of the joint is not less than that of the bars or otherwise satisfies the requirements of a building code or regulation.

One way of joining together two concrete reinforcing bars is by forming a male thread on both bars and a female thread on an intermediate coupler and threading the bars together in the coupler. Unfortunately the threading reduces the tensile strength of the bar and the cutting of the threads is an extra time consuming and inconvenient step.

It is known to join the bars together by means of swaged sleeves and an intermediate member or stud. Such techniques are exemplified by our patents

and (cases and). These techniques are effective but they do require extra steps and involve the use of an extra element; in some cases it is important to ensure that the stud is provided with left and right hand threads.

It is one object of the invention to provide a means and a method to join two concrete reinforcing bars in end-to-end relation without threading the bars, and which will form a joint having the required properties, eg. a tensile strength not less than that of the bars themselves and which involves the use of a two part connector without an intermediate member.

It is another object of this invention to provide a connector and a method of joining reinforcing bars which is quick to assemble on site, is of substantially uniform external diameter, requires no mechanical torquing and which can be performed to the predetermined quality at low over-all cost by unskilled operators.

According to one aspect of the invention there is provided a method of making a connection between two concrete reinforcing bars arranged in end-to-end relation by means of a connector comprising two sleeves, the method comprising

(i) swaging on to a first bar an unthreaded portion of a first sleeve, the sleeve having a bore with a threaded portion which projects beyond the first bar, and

(ii) swaging on to a second bar an unthreaded portion of a second sleeve, the sleeve having an externally threaded end portion, and

(iii) receiving and threading the externally threaded end of the second sleeve in the threaded portion of the first sleeve thereby joining the bars together.

The steps of the method may be performed in any sequence; the threaded parts may be interengaged before both sleeves are swaged on to the bars.

Most preferably the threads are parallel and/or inclined to the major axis of the sleeve, say by about 10 degrees. The threads may be of any suitable shape: threads of V section may be used; in some instances, e.g. for joining bars of relatively larger diameter, it is preferred to use square threads with sloping faces such as ACME threads. Also the lead of the

threads may be greater than the pitch. The lead of the thread may be double, triple or higher; generally a double lead pitch is preferred.

It is important to form the two part connector, especially the male part, of a material which can both be swaged and threaded without any decrease of strength. Steel is preferred. It will be appreciated that in forming the male sleeve threaded part to be received in the female sleeve threaded socket one wishes to avoid an increase in the overall diameter of the sleeve assembly. This may involve a reduction in the cross-sectional area of the part of the male sleeve to be threaded. We have found that by reducing the external diameter of the precursor of the sleeve while holding the other dimensions one can have a threaded male part for a two part connector without losing strength. It is an advantage that the external diameter of the assembled connection is substantially uniform.

According to another aspect of the invention there is provided a connection of two concrete reinforcing bars arranged in end-to-end relation, a first sleeve being swaged to one bar and projecting towards the second bar, the sleeve having a bore with a threaded portion, a second sleeve swaged to the second bar and

projecting towards the first, the second sleeve having an externally threaded end portion which is received in the threaded portion of the first sleeve.

..ccording to another aspect of the invention there is provided a two part connector adapted and dimensioned for use in joining together two concrete reinforcing bars, the connector comprising two sleeves, each sleeve having one end portion for swaging to a bar and another end portion for interengagement with the other sleeve, one of the sleeve engaging parts having a male extension and locating nose, the other sleeve having a female socket for reception of the male extension, the interengaging parts being threaded, and preferably the lead of the threads being greater than the pitch thereof.

Preferably the concrete reinforcing bars range from about 10 mm to 57 mm in diameter. The bars may be of any type and have any rib deformation and are available under a variety of names.

Evaluations have shown that the invention is advantageous because skilled operators are not required on site. There is no need to thread the

bars, nor for an inspection, or extra protection of the threads: the only job done on site is rotation of one bar with respect to the other.

In order that the invention may be well understood it will now be described by way of example with reference to the accompanying diagrammatic drawings in which

Figure 1 shows a system for joining two concrete reinforcing bars B1 and B2 together;

Figure 2 is a sectional elevation of another two bars to be joined: and

Figure 3 is a sectional elevation of the formed joint of Figure 2.

The bars B1 and B2 of Figure 1 are to be joined by means of two sleeves S1 and S2. The sleeve S1 has a bore 1 with an unthreaded portion S1A which has been swaged on to the bar B1 and a threaded portion S1B, which has a screw thread 2 at one end, the right, as seen in Figure 1. The sleeve S2 has a portion S2A with an unthreaded bore 3 and the left hand end portion S2B has an internal thread 4, shaped and dimensioned to complement the thread 2 of the sleeve S1. The sleeve S2 is swaged onto the bar B2 and the thread 4 is then threaded into the threaded bore 2 of

the sleeve S1. The assembled connection of the sleeves is of substantially uniform external diameter, which is an advantage.

In the embodiment of Figures 2 and 3, two lengths of concrete reinforcing bars B1, B2 are to be joined by couplers S3, S4. One coupler S3, the male, comprises a length of steel, originally having a straight sided end portion S3A, which as shown, has been swaged on to the bar B1, a threaded portion S3B, and a nose 7, the portions transist by an integral neck 5. The threaded portion S3B comprises threads 6 which have a multi-lead, ie. a double lead, so that rotation of a nut thereon moves two threads per full rotation. The nose 7 serves for location and alignment into coupler S4.

The coupler S4 has an originally straight sided end portion S4A, and a socket end portion S4B which is internally threaded to receive the threaded portion S3B of the male coupler S3. The threads 8 of the socket S4B mate with those 6 of the male coupler. The mouth of the socket S4B has an internal chamfer to initially guide the nose of the male into the socket. In use, one of the couplers S4, S4 is swaged to a bar B1, B2. For example, the male coupler S3 may be swaged to the bar B1 in a fabrication shop. The female coupler is then swaged to the bar B2 and

brought to the male coupler or vica versa, and by a few rotations the female is threaded on to the male so joining the bars together. (If the bar B2 is too long to rotate, the couplers may be joined and then the bar B2 may be swaged to the coupler S4). The joint formed meets the appropriate building code requirements. The joint is fast to assemble. It is easy for an operator to see that the couplers are properly joined, since no full threads will be left exposed. The bars may range from U.S. size no. 4 (12 mm) to U.S. size no. 18 (57 mm).

The invention is further illustrated by the following example. Two concrete reinforcing bars of diameter specified in the Table below were joined by appropriately dimensioned connectors according to Figure 2 above. The sleeves were swaged on to the bars and the splice was completed by threading the connector parts together to a hand tight connection and then unthreading the connection one half turn to simulate the situation where such unthreading may be necessary for example to join misaligned bars. The joint was then continuously tensioned under a load until the joint failed. The tensile strength was determined by dividing the maximum load by the nominal reinforcing bar area. These results show that the joint had a tensile strength exceeding the 125% of the

specified bar yield strength of 517 Newtons/mm^2 and so the connector would conform for example to the mechanical splice requirement of the American Concrete Institute standard ACI 318. The tensile strength of the joint is in Newtons/mm^2 and the bar yield strength is Newtons/mm^2

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TABLE

No	Bar Diameter	Joint Tensile Strength Joint	Mode of Failure
1	16 mm	602	sleeve fractured
2	16 mm	635	sleeve fractured
3	16 mm	646	sleeve fractured
4	19 mm	669	bar pulled out of male sleeve
5	19 mm	720	bar pulled out of male sleeve
6	19 mm	564	bar pulled out of male sleeve
7	22 mm	655	bar pulled out of male sleeve
8	22 mm	660	threads failed
9	22 mm	724	bar pulled out of male sleeve
10	26 mm	646	pull out
11	26 mm	658	pull out
12	26 mm	627	pull out
13	32 mm	693	sleeve fractured
14	32 mm	668	sleeve fractured
15	32 mm	707	sleeve fractured
16	35 mm	577	sleeve fractured
17	35 mm	556	threads failed

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CLAIMS

1. A method of making a connection between two concrete reinforcing bars arranged in end-to-end relation by means of a multipart connector comprising two sleeves, the method comprising swaging on to a first bar on unthreaded portion of a first sleeve, the sleeve having a bore with a threaded portion which projects beyond the first bar, and swaging on to a second bar an unthreaded portion of a second sleeve, the sleeve having an externally threaded end portion which projects beyond the second bar, and characterised in that the connector comprises two sleeves only, and by receiving and threading the externally threaded end of the second sleeve in the threaded portion of the first sleeve thereby connecting the bars together.

2. A method according to Claim 1, characterised in that the threads are parallel and/or inclined to the major axis of the sleeve.

3. A method according to Claim 1 or 2, characterised in that the threads are of V slope or square shape with sloping faces.

4. A method according to Claim 1 or 2, characterised in that the threads of the sleeve are shaped such that the lead of the threads is greater than the pitch thereof.

5. A method according to claim 4, characterised in that the thread has a double lead pitch.

6. A method according to any of Claims 1 to 5, characterised in that the sleeves are shaped such that the external diameter of the assembled connection is substantially uniform.

7. A method according to any of Claims 1 to 6, characterised in that the concrete reinforcing bars range from about 10 mm to 57 mm in diameter.

8. A connection of two concrete reinforcing bars arranged in end-to-end relation, a first sleeve being swaged to one bar and projecting towards the second bar, the sleeve having a bore with a threaded portion, a second sleeve swaged to the second bar and projecting towards the first, the second sleeve having an

externally threaded end portion, characterised in that the externally threaded portion of the second sleeve is received in the threaded portion of the first sleeve.

9. A two part connector adapted and dimensioned for use in joining together two concrete reinforcing bars, characterised in that the connector comprises two sleeves only, each sleeve having one end portion for connection to a bar and another end portion for interengagement with the other sleeve, one of the sleeve engagement parts having a male extension and locating nose, the other sleeve having a female socket for reception of the male extension, the interengaging parts being threaded.

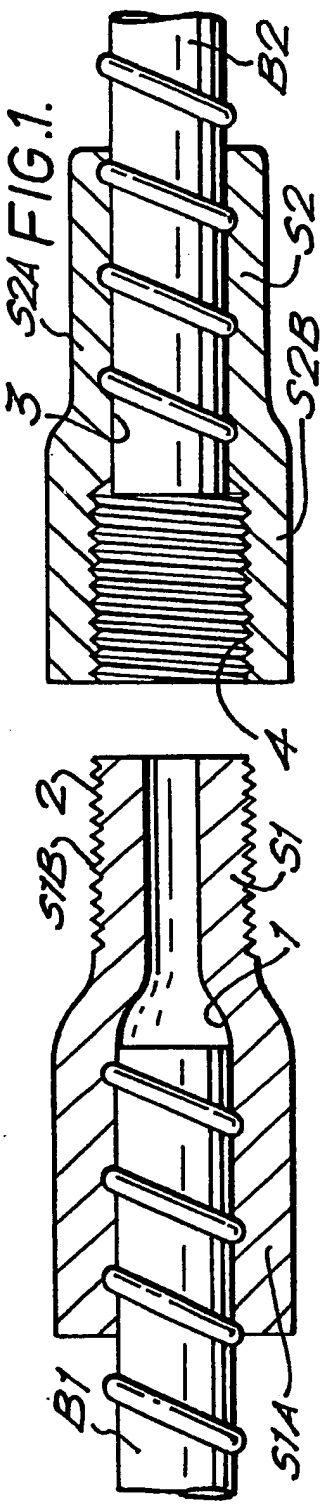

FIG.1.

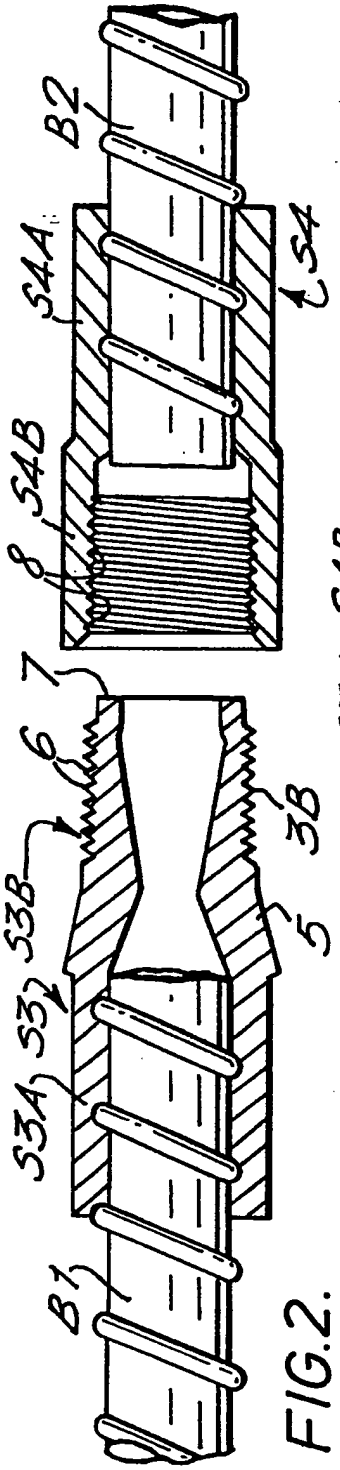

FIG.2.

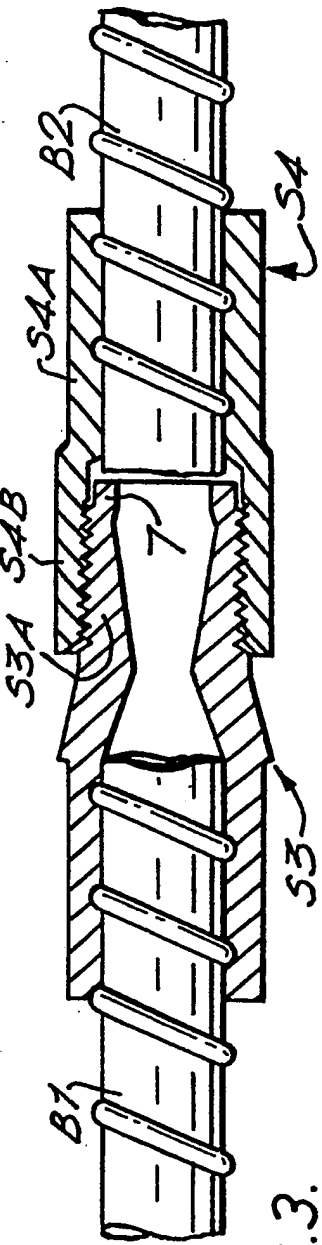

FIG.3.